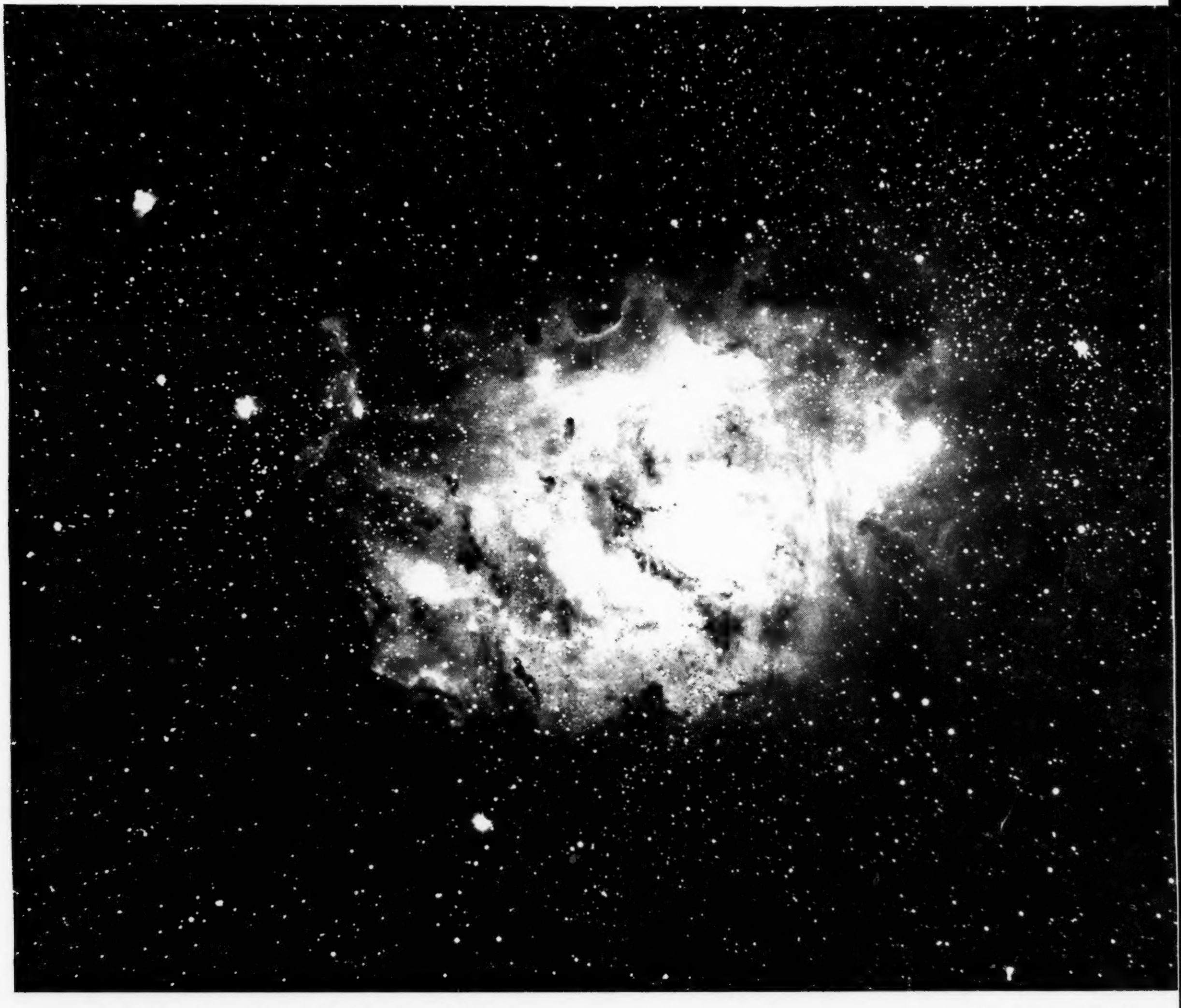
THE MONTHLY

MAP

The Stars Brought Down To Earth

VOL. LIV NO. 506



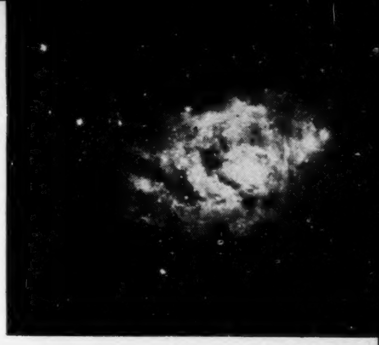
THE LAGOON NEBULA IN SAGITTARIUS

FIFTY CENTS

JULY • AUGUST

FOUNDED IN 1905 BY
LEON BARRITT

THE MONTHLY EVENING SKY MAP



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THE MONTHLY EVENING SKY MAP

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COVER PHOTO

This issue's cover photo of Messier 8, the Lagoon nebula in Sagittarius, was made with the Crossley reflector of the Lick Observatory. The small, dark globules silhouetted against the bright background of the starlit nebula are a subject for study in themselves. Astronomers believe that they are composed of increasing amounts of interstellar dust, and that, as they compress, they are becoming hotter and hotter—until some day, millions of years from now, they will become stars. Literally, the birth of a star!

EQUATORIAL vs. ALTAZIMUTH

Dr. J. H. Schrant of Hutchinson, Kansas, writes to inquire if the 3-inch telescope referred to in "Through the Three-Inch" (March-April) was equipped with an equatorial mount, and if so, what our opinion on such a mount might be.

The 3-inch Fitz refractor mentioned in the feature *is* equatorially mounted, but its user wishes it were not. This is no condemnation of a smooth-working equatorial mount, but applies only to the intended use of the telescope. The writer uses this instrument for those "stolen moments" of sky-watching that would be lost to a more unwieldy instrument—of which he owns or has owned several.

Of necessity, an equatorial mounting, which is primarily designed to follow an object with one simple motion, adds to the bulk and weight of a telescope. The heavy axes and projecting counterweight can make its bearer both irritable and a dangerous hazard. If improperly designed, the complication of its construction can affect the mount's steadiness and the apparent complication of its use to the occasional user can make it difficult to direct easily to various parts of the sky.

However, a well-designed equatorial mounting with a smooth slow-motion drive and clearly marked setting circles can be a joy for the serious observer, regardless of the telescope's size. It is assumed that any observer who purchases one of the excellent equatorially mounted telescopes now on the market—or who makes his own—*is* serious, at least to the extent that he knows what he wants and what he is getting.

In the design of a telescope mount, simplicity is next to godliness, and the writer has seen many which benefited from neither. However, an altazimuth mounting, preferably of the fork type with the tube suspended between, is simplicity itself. The fork is offset to allow zenith observation, and the up-and-down-and-around motion is both easy and natural. The altazimuth mount is classic, and allows the user to become a part of it and it a part of him. It is lighter, less bulky and more economical than an equivalent equatorial mount.

For brief observing sessions at low or medium magnifications; for ease of transportation; for economy of space and money — the altazimuth has it.

For serious planetary observing; for the location of faint objects with setting circles; for the more experienced amateur with only one telescope—the choice favors the equatorial mount.

In a final answer to Dr. Schrant—and to crawl away before being attacked—the writer can only say yes! . . . one "can get along nicely without an equatorial mount" . . . yet an experienced observer can get along even better *with* one!

—DDZ

The staff of the Sky Map has been encouraged by the many notes of approval which have come to us from individuals, clubs, professional astronomers, observatories and planetariums. We are only sorry that we can't acknowledge each one personally. Circulation has tripled since the first of the year, but each reader can play a part in making the Sky Map the amateur's own magazine by showing it to friends and suggesting that they subscribe. Each new subscription adds to the extra columns of information we can bring to you—and there is so much to talk about in astronomy!

DISCOVERING THE MILKY WAY . . .

an annual event, says the writer!

By Armand N. Spitz

For the majority of people, no matter how long they have been interested in astronomy, there are few objects which have been as frequently rediscovered as the Milky Way. Year in, year out, for the majority of the people who habitually turn their eyes to the heavens, there come too infrequently those crystal black nights when the galaxy declares itself for what it is—the all-embracing cosmic circlet which typifies and symbolizes the unit of which we and it are a part.

We know the structure of the galaxy. We know the place of the solar system in the galaxy. We know the immensity of it all. But there are few who can refrain from sharing comment on a strangely beautiful view of "the broad and ample road whose dust is gold and pavement stars."

Unblessed by the advantages of modern civilization, the Egyptian may have sensed this heavenly identity more frequently. To him the Milky Way represented the course of the sacred river flowing through the land where the departed souls of his ancestors lived in perpetual happiness under the benign guidance of Osiris. But of course it must be remembered that the Egyptians knew neither smog nor traffic lights, nor advertising signs.

Anaxagoras didn't know the advantages of modern civilization, either. Nevertheless, he realized that the brightness of the sun made stars invisible. The sun shines on most of the sky, even in the night time, except where its shadow falls. The earth has a long, long shadow, said Anaxagoras, and this stretches infinitely into space. In this shadow, the light of the faint stars is not overpowered by the sun, and therefore we see more stars in the part of the sky covered by the shadow than outside of it. This, mused Anaxagoras, is the Milky Way. But Anaxagoras was unpopular. He was convicted of impiety, and he died in exile. So, of course, his idea could not be true.

But Aristotle had a good idea. Dry, hot exhalations sometimes are carried up into the highest part of the atmosphere where everything is fiery. This atmosphere is part of the daily rotation of the heavens and these exhalations take fire under the influence of the sun. It is constantly being formed under the influence of the motion of the fixed stars and substantially occupies the same position in the sky. To Aristotle this explained why there are so many stars along the Milky Way.

When Tycho of Uraniborg discovered his "new star" of 1572 in the constellation of Cassiopeia on the edge of the Milky Way, he assumed that it was made of celestial matter which probably came from the nebulous material of the Milky Way. Other stars were solid and firm. Obviously, anything which came from the Milky Way would be thin and tenuous, and this accounted for the rapid disappearance of Tycho's star.

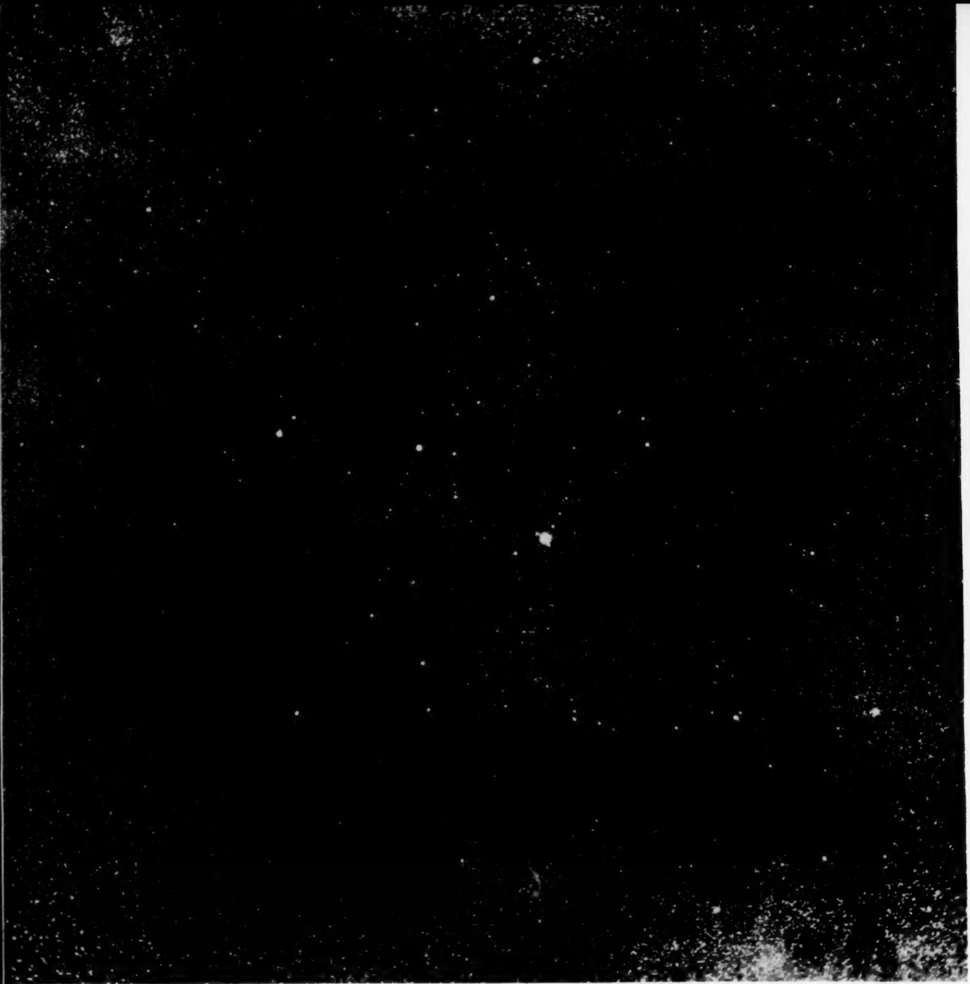
And other theories which followed were equally "thin and tenuous," but the mind of man had been captivated and bewitched by the silvery band above him. This situation continued to twinge and twist the imaginations of the "natural philosophers" until just 350 years ago, when Galileo, in 1610, turned his little "optick tube" on the Milky Way and discovered for the first time its true composition . . . a concentrated band of faint stars.

From this time on, the galaxy has slowly taken shape before us. The elder Herschel made star counts in selected areas of the sky, and from statistical studies of these counts developed our first crude picture of our galaxy. He placed the sun near the center—a happy coincidence, for only a few centuries before man had been displaced from the center of the solar system, and this new status bolstered his flagging ego. It has been only during the last decade that we have decided that Herschel and those who followed him with even more brilliant statistical studies were concerning themselves with a star cloud within the Milky Way galaxy, and that we are actually near the edge. The center of the galaxy, we are told, is some 25,000 light years away in Sagittarius.

Our discoveries have led us down a fascinating path. But, along the way, the Milky Way—path, bridge or celestial river—has been the inspiration for more folk tales, poetry and prose than any other celestial object. As new tools to measure and define our universe have been given us, each one has in its way added another brush stroke to the great spiraling mass building up on the canvas before us.

The whole story of astronomy and its growth might be epitomized in the story of the Milky Way. The achievement of man in solving his technical problems goes hand in hand with his learning more about the galaxy. New discoveries lead to more discoveries. But where is there a discovery so elemental, a rediscovery so thrilling, and an awareness so intense—as that which you and I and all others like us experience on that too rare night when we find our hearts and souls expanding as we see the splendor of the Milky Way!

HEART OF THE GALAXY! This spectacular photograph centers on the great star cloud in Sagittarius, the nucleus of the Milky Way. Near the top (north) is the Lagoon nebula shown on the cover and, above and to its right, the Trifid nebula. Plate was taken by Alan McClure of Los Angeles.



The dark rifts and masses of obscuring matter fascinated the pioneer celestial photographer Edward Emerson Barnard as much as the sea of stars. This photograph is centered in the Ophiuchus branch of the Milky Way. Star just below center is Theta Ophiuchi, above and between Sagittarius and Scorpius. Just above and to left of Theta is Barnard's dark object B72—in the shape of a black "S". All photos with this article not otherwise credited are from Barnard's "Atlas of Selected Regions of the Milky Way," published in 1927 by the Carnegie Institution of Washington.

THE MILKY WAY . . . *through a glass darkly*

The night is very dark. It hangs over us as a cloak to shut out the impudent city lights and noises we have left behind—for a moment we grope and stumble in our uneasiness, as if we had suddenly walked from the out-of-door world into the blinding light of the parlor. But then, the sky begins to take its shape above us, and our uneasiness passes as we make our peace with nature and turn our heads upward. The stars are laid out above us on black velvet, each one a choice-cut diamond whose facets we have only begun to sense.

But then . . . distress! We look deep into the southeastern sky—are those clouds to disrupt our long-sought night beneath the stars? As we strain to detect movement, our eyes begin to adjust to their new environment and we realize once again that we have rediscovered Man's most ancient mystery—the Milky Way.

And then, as the spinning earth wheels the skies westward and the Milky Way assumes its rightful position above us to reign the night long, it becomes a spectacle to be treasured and savored. The double stars, the planets, even the distant spiral galaxies fade from our mind's eye as we set ourselves for a night of observation and wonderment.

But, of course, many of us have looked at the Milky Way before. Yet, have we really seen it? Do we "look," or do we "see?" It's quite easy to "look," you know—you just aim your eyes at something and there you are. Every person whose bedtime allows has, at one time or another, "looked" at the Milky Way. But to "see" the Milky Way—to aim with a purpose and hit the mark—is another matter, and is precisely why we are here.

Now, a casual view of the Milky Way—the luminous ribbon of light girdling our starry dome—is in itself enough to absorb our interest, but soon we begin to wonder what it is we're viewing. Probably the first act of intellectual curiosity performed by early man—after he had fed, clothed, warmed and protected himself—was to rear up on his haunches and look to the stars. Perhaps he didn't phrase his questions aloud, but a look at the stars, and especially at the sprawling Milky Way, begs questions.

It was probably on that night that Original Man had his first glimpse of the universe that the race of Man first deserved the capital "M" with which we dignify our species. It was a dramatic breakthrough from an animal to a human existence, and the effect of the further curiosity this experience stimulated is difficult for us to estimate today. It took Man out of himself and set him on an uncharted course of experience which is now beginning to carry him to other worlds.

But for a long time—for an unbelievably long time — there were only questions. In his accompanying

The photos on this page, cevering large areas of the Milky Way, were made in the late 19th century by Barnard, using a "magic lantern" lens. This photo shows the Cygnus-Aquila section, with North American nebula and Deneb at upper left.

article, Armand Spitz touches on some of the answers which were given to these questions. They were scarcely the kind of answers you would expect in a time when men were applying reason and logic so effectively in other fields of pursuit. But, bad answers bring better questions, and soon man began to piece together the fragments of the puzzle. First, though, let's look at the puzzle.

Our eyes have adapted themselves to the darkness now, and as we pause in our musings and look up once more we see that the sky is a blaze of light. Stars we have never known blink down at us, and we feel a bit lost. The dim blur to the east of us is our last touch with our urban world, that smog curtain of light and dust which condemns even the suburbanite to a life of partial detachment from the universe. Nevertheless, it gives us a touch of reality, for the world about us seems very unreal. Those cursed trees . . . the neighbor's porchlight . . . the apartment building across the way . . . all these landmarks are gone, and we must learn to make our way among the stars by stars alone. We'll set our course along the Milky Way!

Low in the north on this midsummer night the Milky Way first appears, rising up from Auriga and Perseus amid a profusion of horizon-dimmed open clusters, then becoming prominent in Cassiopeia and Cepheus. Finally, above us, in the Northern Cross of Cygnus, the clear air of the zenith allows the bright band to break into full splendor.

But, just as this explosion of light is upon us, with the Cross floating on a sea of stars, the band of whiteness is suddenly cleft by a dark rift which seems to pull the Milky Way apart at its seams. As we turn and follow this rift through Cygnus and down into the southern sky, we watch it widen as it passes west of Altair in Aquila, as if a "divided pavement" were the order in this congested area. And congested it is becoming, for we're now in Ophiuchus, and just to the east is a magnificent island of light, the Scutum Cloud.

And here we pause. For there is no longer need to ignore the accumulated intelligence of mankind. We come to this celestial convention as instructed delegates. Pointing our binoculars toward the Scutum Cloud we see this radiant clump suddenly explode before our eyes into countless millions of stars—with a raise of our hand we have brought ourselves across the eons from Original Man to Extraordinary Man . . . to a time

Near center is the star cloud in Scutum, with open cluster M11 prominent near its northern edge. Pinpoint details of faded original photos have been partly lost in reproduction.

just 350 years ago this summer when Galileo Galilei first directed his "optick tube" toward the Milky Way and fathomed its secret.

The field of our binoculars swims with stars—and with the light of stars we cannot see. For the first time we can sense the immensity of the system of stars before us when we realize that, should all the stars in the sky visible in a 3-inch telescope be suddenly blotted out, the great span of light of the Milky Way would shine on undiminished!

Dropping our glasses, we leave Galileo staring into the soft Paduan night and step back to let the celestial machinery carry us into the middle of the 18th century. We now take a sailor's-eye view of the Milky Way, the same view seen by Thomas Wright in 1740, but one interpreted with a scientist's mind. In his years at sea, Wright had stared at the Milky Way in both southern and northern latitudes, and he couldn't accept the idea that Creation had played favorites and grouped most of the visible stars together in a tight, restricted band across the sky. Instead, Wright saw this apparent concentration of stars as a lens-shaped system. A bird flying across a pine forest would see each tree individually, but a man viewing this great stand of timber from the deepening shadows of its edge would see it as an impenetrable forest.

So once again, Man had been delightfully fooled. Excused, perhaps, by the fact that he had not yet acquired his space-wings, Man had not been able to fly over the Milky Way and quite literally had not been able to see the forest for the trees! Although he had mapped many thousands of stars, and had clocked their movements with unquestioned precision, Man had never stepped back for a "wide-screen" view of the celestial spectacular before him.

Before Herschel, the organist of Bath, the facts began to take form. William Herschel was possibly the greatest creative genius ever to turn his efforts to observational astronomy, and his work was all the more remarkable because the paths it took had no precedent. This was certainly the case when he undertook his task of counting the stars. Of course, Herschel realized that he could not possibly tick off *all* the stars that came within the realm of his 12-inch reflector, so he selected certain areas of the sky and made a count of the stars in its field of view at these specified points.

(*Continued on Page* 8)

The Milky Way in the region of Sagittarius and Ophiuchus. Lagoon and Trifid nebulae show in lower portion of this photograph, just above the large Sagittarius Cloud.

(*Continued from Page* 7)

From the statistics gained in this survey, Herschel was able to confirm the idea of Thomas Wright. Herschel, however, saw the Milky Way as a disk-shaped system, and estimated it to be about five times its thickness. The sun was near its center.

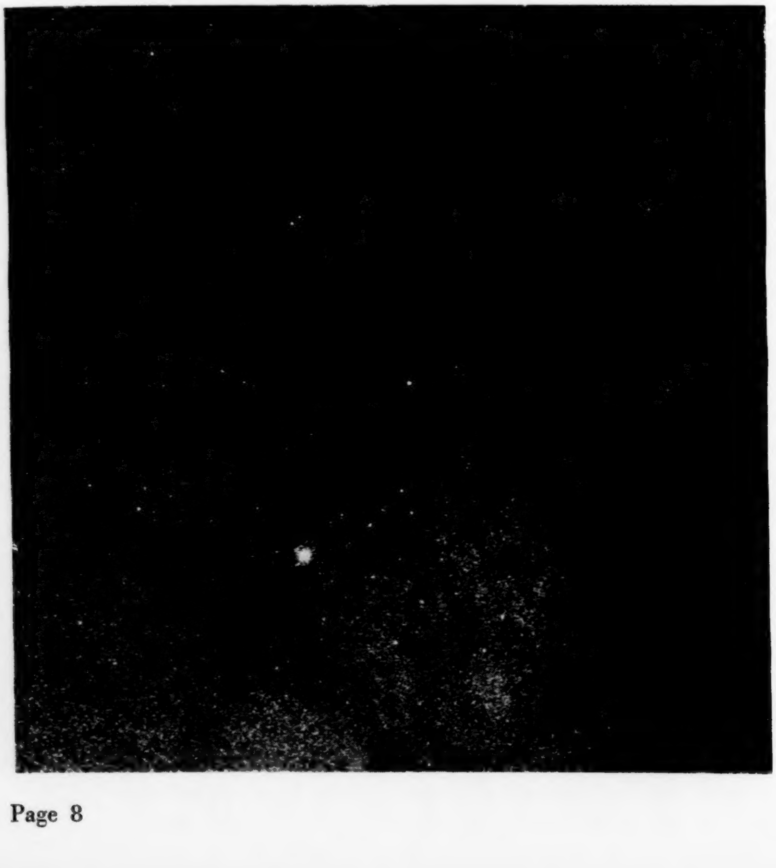
The sun was near its center! How natural that Man, deposed just 250 before from his divine throne at the center of the solar system, now became a king-maker himself and placed the sun at the center of his Milky Way universe. But he had made a giant step into space, so let him rule for the moment, we say.

Besides, we have controlled ourselves long enough. Even in our mid-northern latitudes the flickering magic of the Sagittarius star cloud leads the observer down into the southern sky like the pipes of Pan. Twinkling and filmy though it is through its low curtain of air, the Milky Way in Sagittarius crashes into a wall of grandeur which no telescope has completely penetrated. A second great rift plows along the borders between Sagittarius and the rich confines of Ophiuchus and Scorpius, but only accentuating the celestial "smorgasbord" that lies to its east.

To describe this area of the Milky Way is difficult enough—to fathom its depths seems impossible. "There," wrote the great observer E. E. Barnard, "the stars pile up in great cumulous masses like summer clouds." In the introduction to his monumental *Atlas of Selected Areas of the Milky Way*, Barnard describes having watched the Sagittarius Cloud appear in fragmented fashion through breaks in a thin, rapidly moving deck of clouds. It is only then, he suggests, when one's attentions are focused on the rich, glowing star clouds and the inky blackness at their borders, that a real appreciation of their brightness can be had.

For the moment we pull ourselves away from a deeper inspection of the Milky Way in Sagittarius. Along our travels down the Milky Way from Cygnus and into Sagittarius, we have become acutely aware of dark rifts. Herschel, too, was aware of these, and referred to them as "holes in the sky." We cannot argue with this apt description, but we can maintain our perspective and not be guided too literally. Vainly, Herschel searched these "windows in Heaven" for island universes, but found none, so checked them off casually as the comet-hunter Messier had done with the errant "nebulae" which plagued his comet searches.

Again, we were seeing the trees, and not the forest. At the turn of the 20th century the Dutch astronomer J. Kapteyn had continued the statistical studies of Herschel, and he and his colleagues produced a brilliant survey of stars in selected areas of the sky which further established the sun's eminence at or near the center of the Milky Way galaxy. Had we taken a better look at our "holes in the sky," instead of trying to see through them, we might have learned earlier that these holes were actually masses of dark, obscuring matter. In many spots these dark masses were condensed and silhouetted against the starlight behind, but in other less dramatic cases this interstellar dust did not appear to our view. Our previous statistical studies of the brightness and distribution of stars within and without the Milky Way were based upon the assumption that fainter stars were, in general, farther from us. This in itself was a safe assumption, it turns out, but our classic and tidy view of the vacuous emptiness of space had not allowed



This Milky Way photograph by Barnard, made with the 10-inch Bruce lens at Lick, shows the northern edge of the Scutum Cloud. Conspicuous below center in this picture is the fan-shaped cluster, M11, with bright star apparently embedded within it.

for interstellar dust—a dust which was absorbing much of the light of the stars beyond it and completely lousing up our statistics.

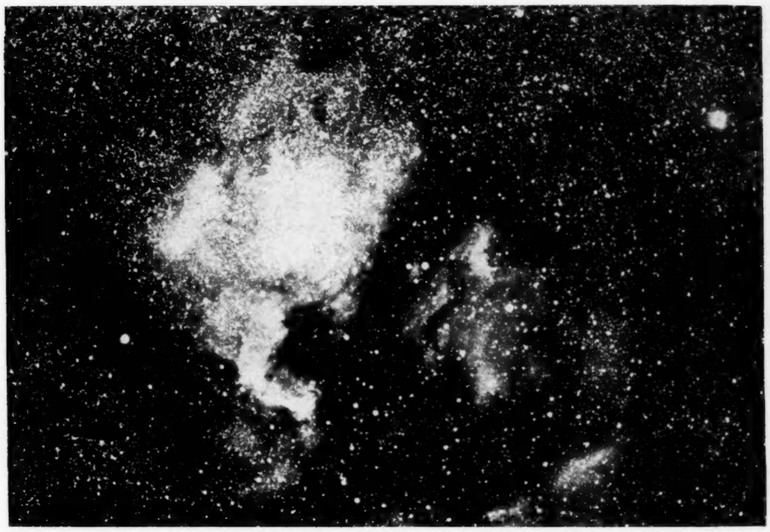
When you finally know you're wrong, you can start being awfully right. Celestial yardsticks were soon redesigned, previous studies interpreted anew. Then Shapley began to locate the short-period Cepheid variable stars in our galaxy's globular clusters; he found a relationship between their periods of fluctuation and their actual brightnesses, a relationship that enabled us to use them as galactic measuring-sticks and delineate the boundaries of the Milky Way. Using these methods, he was able to suggest that the center of the Milky Way was not in the area of our sun and its neighbor stars, but some 27,000 light years away—in the great star cloud of Sagittarius. Later, the work of Jan Oort in Holland, where he had been studying the rotation of the galaxy, confirmed that the center of rotation of the Milky Way lay in Sagittarius.

And—as we look once more into the blinking blur of jammed-up stars and nebulosity in Sagittarius, how can we doubt this? Looking back overhead to the beginning of the great rift in Cygnus, how could we look on this dark slash through the plane of the Milky Way as anything but a mass of obscuring, absorbing interstellar dust? True, it is easy to second-guess, but even modern Milky Way astronomers, with all sympathy for the problems of their predecessors, wonder, as does Bart Bok, why no one ever stepped back and took a look at the over-all picture.

Sergei Gaposchkin of Harvard, in his introduction to an article on "The Visual Milky Way" in *Vistas in Astronomy* (Vol. III), writes:

> "If the astronomers in the last century had possessed, in the world of stars, an artistic genius equal to their intellectual grandeur, the realization of the fact that the dramatic multitude of stars is located not in the vicinity of the Sun, but in the direction of Sagittarius - Scorpius, would have dawned not in the twentieth but in the nineteenth century. A visual representation of the whole Milky Way would have revealed this at once."

However, there are problems enough ahead. For centuries we have figuratively been lost in a fog that is just beginning to clear. We soon realized that we were in a large city, and on occasions we had glimpses of familiar landmarks in the distance. Around us we heard a Babel of voices, but eventually we began to isolate a predominant tongue. Obviously, we reasoned, we are in the heart of a great city where English is spoken and where fog is common —London. As the fog begins to clear, we realize that we *are* actually in London, but in the foreign district of Soho in southern London, not at the center of the city at all. We hear talk among the customers entering the Chinese restaurant that Oxford street is just to the north, but we are in for a bit of stumbling if we are to reach Piccadilly Circus. Even to Londoners, it's still a foggy day in London Town!

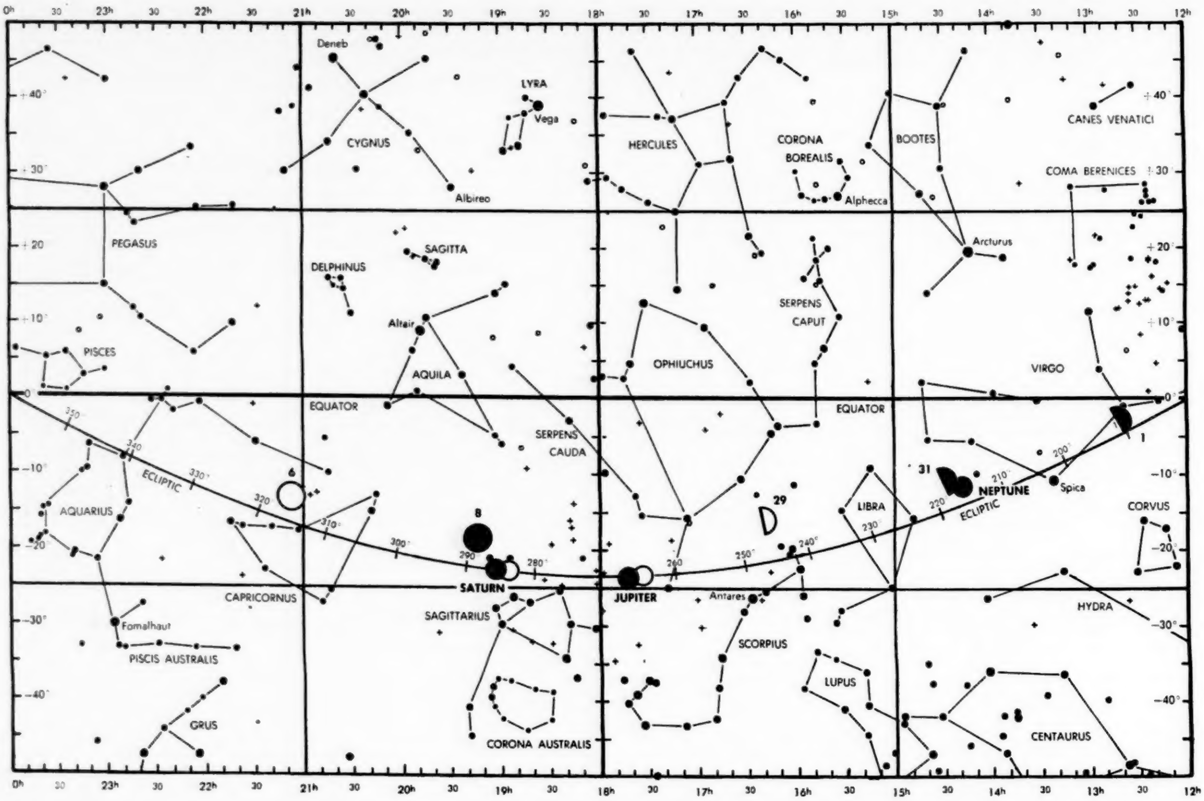


The North American nebula, near Deneb (star at right) in Cygnus, is an excellent target for the low-power, wide-field "richest field" telescopes discussed on page 19 of this issue. Dark "bay" that forms outline of "Gulf of Mexico" is mass of intervening matter. Aptly named "Pelican" nebula is at right. Photo courtesy of Alan McClure, Los Angeles Astronomical Society.

Foggy though it is, we are already mapping the spiral arms of the new Milky Way galaxy, and we are finding our way about by learning a new language—the language of radio astronomy. Visually and photographically, we are seeing only an edge of the nucleus of the Milky Way galaxy, but our radio astronomers in Holland, England, Australia and the United States are using the selective radio frequencies to tune in behind the Black Curtain of interstellar dust. The pace is accelerating now, and the answers are nearly outdistancing our questions.

But look—the Milky Way is fading now in the southwest and the light of dawn is already coloring the eastern sky. We've been on a wild and awesome ride tonight, and there are still a few moments to relax and capture a bit of telescopic game for our bags. But we shall never be quite the same again, you know, for our minds have been stretched a bit tonight—we've seen the Milky Way!

—DDZ



EQUATORIAL SKY MAP

The charts on these pages show the star field from the equator to 50° south and 50° north. Right ascension is measured from west to east in hours; each notch at the top and bottom of the charts represents 10m of right ascension. Declination is measured to the north and south of the equator in degrees plus or minus; each notch at the right and left of the chart represents 5° of declination. Longitude along ecliptic is measured in 10° segments.

JULY AND AUGUST AMONG THE PLANETS

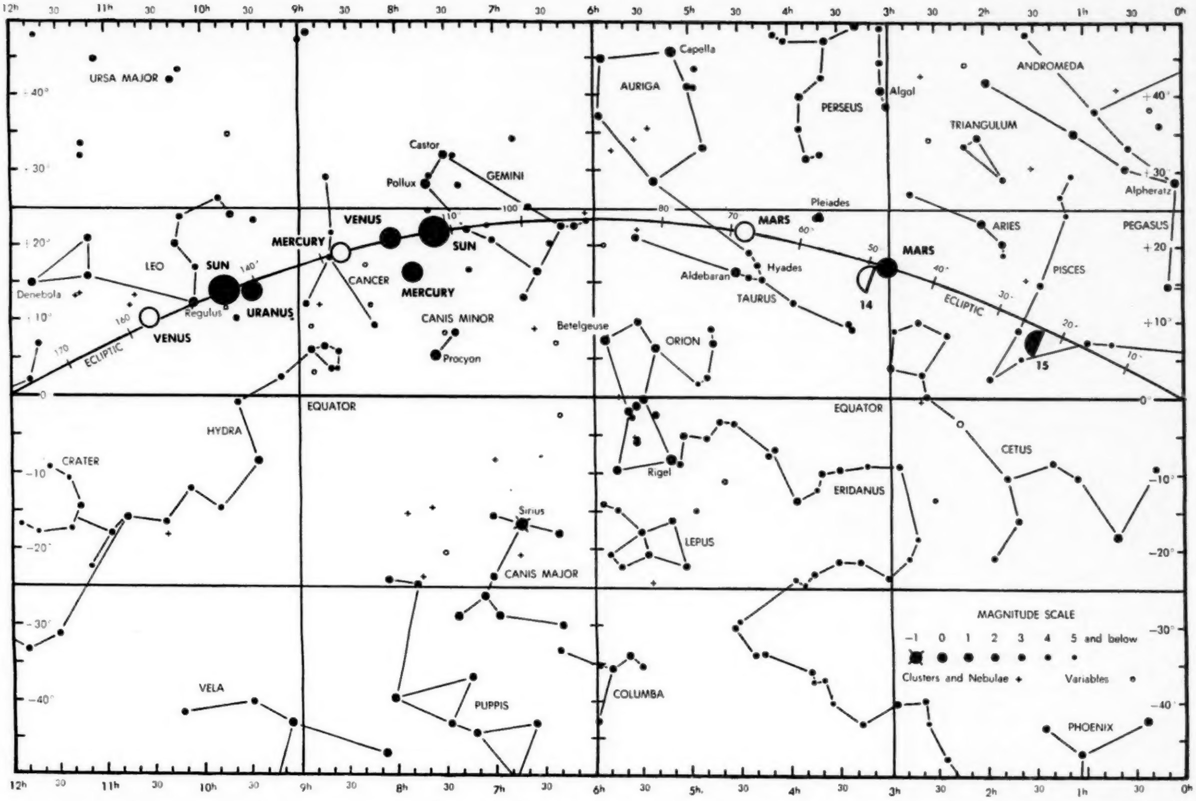
SUN: During July the sun moves from Gemini into Cancer; during August it passes eastward into Leo. There were several large sunspot groups observed in early June; on June 3rd, after observing these spots in the late afternoon, several St. Louis observers enjoyed an auroral display later in the evening. The display lasted for nearly an hour and a half, and at maximum intensity the pink streamers and rays reached an altitude of 40° in the northern skies.

MERCURY: Mercury is in Gemini in July, moving into Cancer in August. On July 17th Mercury passes between the earth and the sun (inferior conjunction), and therefore is not observable. However, on August 4th it reaches its greatest apparent angular distance (elongation) west of the sun (19°), and will be visible briefly in the dawn twilight for several days, shining at an inconspicuous 0.6 magnitude. By August 30th Mercury passes into superior conjunction, passing directly behind the sun in relation to the earth.

MARS: Mars begins July in Aries, then moves into Taurus during mid-July and August. During July it becomes a more conspicuous object, ruddy and bright at 1.0. By the end of August it brightens to 0.6, and will be exhibiting a disk of more than 7 seconds of arc—just a teaser in small instruments. Opposition will occur at the end of the year; although it will not show as large a disk as recent close passes, Mars will be high in the sky for clear, steady images. By the end of August, the planet will rise at midnight and remain in the morning sky until dawn.

JUPITER: The giant planet will be visible throughout the evening low in the southern sky in Sagittarius during July and August. It begins July with a magnitude of –2.2 and an equatorial diameter of 46 seconds of arc; by the end of August it will be –1.9 and 41 seconds of arc across. Making drawings of its ever-changing atmospheric features and following the elusive satellites (I, Io; II, Europa; III, Ganymede; and IV, Callisto) are among the favorite pastimes of amateurs. Positions of these satellites and times for their phenomena may be found elsewhere in this issue.

SATURN: East of Jupiter in Sagittarius, Saturn reaches opposition on July 7th, shining at 0.3 at this time. During July and August the ringed planet's ball will be about 18 seconds of arc in diameter; its rings will measure more than 40 seconds of arc across. Saturn is al-



The charts indicate the positions of the sun and the naked eye planets for the 15th of each month, and for the mean positions of Uranus and Neptune during the two-month period. Position and date of phase for moon is shown at first quarter, full and last quarter. Positions of planets and moon for July is indicated by black circles; for August by outlined circles.

Chart is a natural projection and contains all stars through fifth magnitude (and some fainter). Bright stars are labeled with their proper names. Clusters and nebulae in Messier's catalogue are included, as are all variable stars with maxima brighter than magnitude 8.0. Circumpolar stars may be located on the evening and morning sky maps for this month.

ways a beautiful sight in small instruments—fragile, distant, and a bit eerie as it sails majestically across the field of view like a celestial galleon. Titan, its brightest satellite, can be picked up easily around the times of its greatest distance west or east of the planet: (east) July 9, 25, Aug. 10, 26; (west) July 1, 17, Aug. 2, 18.

URANUS: In Leo, which dips low in the west at sunset, so the planet is of little interest now. It is in conjunction with the sun on Aug. 14th.

NEPTUNE: Between Virgo and Libra during July and August; in the Southwestern sky after sunset. On July 15th its position is R. A. 14h 19m, Dec. 11° 57′ S.; on Aug. 15th, R.A. 14h 19m, Dec. 12° 03′ S.

(See *Skywatcher's Diary* for further data on planets.)

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BEGINNING AND END OF MORNING TWILIGHT (LOCAL MEAN TIME)

		Beginning				End			
Latitude (N.)		30°	35°	40°	45°	30°	35°	40°	45°
July	3	3:27	3:04	2:33	1:47	**8:41**	**9:04**	**9:34**	**10:19**
	8	3:30	3:07	2:38	1:54	**8:39**	**9:02**	**9:31**	**10:14**
	13	3:33	3:11	2:43	2:02	**8:37**	**8:59**	**9:27**	**10:07**
	18	3:37	3:16	2:49	2:11	**8:34**	**8:55**	**9:21**	**9:59**
	23	3:41	3 21	2:56	2:20	**8:31**	**8:50**	**9:15**	**9:50**
	28	3:45	3:26	3:03	2:30	**8:26**	**8:45**	**9:08**	**9:40**
August	2	3:50	3:32	3:10	2:40	**8:22**	**8:39**	**9:01**	**9:29**
	7	3:54	3:37	3:17	2:50	**8:16**	**8:32**	**8:52**	**9:19**
	12	3:58	3:43	3:25	3:00	**8:11**	**8:25**	**8:44**	**9:07**
	17	4:02	3:49	3:31	3:09	**8:04**	**8:18**	**8:35**	**8:56**
	22	4:07	3:59	3:38	3:18	**7:58**	**8:10**	**8:26**	**8:45**
	27	4:11	3:59	3:45	3:27	**7:51**	**8:02**	**8:16**	**8:33**

The tables above are designed to guide the observer in planning observing schedules and determining rising and setting times of the sun. Two corrections must be made: Latitude must be interpolated, and the local mean time of the tables must be converted to standard zone time. **Add** 4 minutes for each degree **west** of nearest standard time meridian; **subtract** 4 minutes **east** of meridian. (In areas observing daylight saving time, use standard time of zone to your east.)

Light type—a.m. **Bold type**—p.m.

SKY WATCHER'S DIARY

JULY

Date	Hour (EST)	Event
1	23	Moon at first quarter
2	9	Asteroid Vesta at opposition
	15	Mercury stationary
3	20	Neptune 2° S. of Moon
7	1	Saturn at opposition
	7	Jupiter 5° S. of Moon
8	6	Moon at perigee (221,900 miles)
	13	Saturn 4° S. of Moon
	15	Full Moon
11	12	Asteroid Pallas at opposition
15	11	Last quarter Moon
16	20	Mercury in inferior conjunction
17	12	Mars 3° N. of Moon
18	17	Neptune stationary
19	5	Aldebaran 0°.4 S. of Moon
21	9	Moon at apogee (252,500 miles away)
23	14	New Moon
25	6	Uranus 3° N. of Moon
27	6	Mercury stationary
29		Delta Aquarid meteors
31	3	Neptune 2° S. of Moon
	8	Moon at first quarter

AUGUST

Date	Hour (EST)	Event
1	10	Venus 1°.8 N. of Uranus
3	13	Jupiter 5° S. of Moon
4	20	Saturn 4° S. of Moon
5	12	Mercury 8° S. of Pollux
	14	Mercury greatest elong. W. (19°)
	16	Moon at perigee (223,500 miles)
6	22	Full Moon
8	6	Asteroid Juno stationary
	9	Venus 1° N. of Regulus
11		Perseid meteor shower
13	22	Vesta stationary
14	0	Uranus in conjunction with Sun
	15	Asteroid Ceres at opposition
15	9	Mars 4° N. of Moon
	12	Aldebaran 0°.3 S. of Moon
17	7	Mars 5° N. of Aldebaran
	20	Moon at apogee (252,000 miles)
20	13	Jupiter stationary
22	4	New Moon
23	17	Venus 1° N. of Moon
27	9	Neptune 2° S. of Moon
29	1	Pluto in conjunction with Sun
	14	Moon at first quarter
30	19	Mercury in superior conjunction
	20	Jupiter 5° S. of Moon

(Times are for EST. For areas on Daylight Saving Time, add 1 hour, then convert to standard time of your zone.)

PHENOMENA OF JUPITER'S SATELLITES

JULY

d	h	m	Sat.	Phen.
3	1	07	III	TI
	2	24	III	SI
4	1	29	I	TI
	1	49	I	SI
	21	40	II	OD
	22	43	I	OD
5	1	03	II	ER
	1	18	I	ER
	22	08	I	Te
	22	32	I	Se
11	23	57	II	OD
12	0	27	I	OD
	21	40	I	TI
	22	13	I	SI
	23	54	I	Te
13	1	27	I	Se
	21	09	II	Te
	21	41	I	ER
	22	17	II	Se
	23	19	III	ER
19	2	13	I	OD
	2	16	II	OD
20	0	08	I	SI
	1	40	I	Te
	21	25	III	OD
	22	15	II	SI
	23	26	II	Te
	23	35	I	ER
21	0	52	II	Se
	20	06	I	Te
	20	51	I	Se
27	22	26	I	OD
	23	10	II	TI
28	1	49	II	SI
	1	53	III	OD
	20	32	I	SI
	21	53	I	Te
	22	46	I	Se
29	22	15	II	ER
31	21	22	III	Se

AUGUST

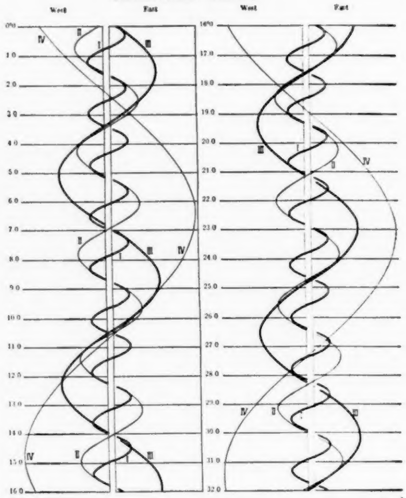
d	h	m	Sat.	Phen.
4	21	29	I	TI
	22	27	I	SI
	23	42	I	Te
5	1	41	I	Se
	21	53	I	ER
6	1	53	II	ER
7	21	12	III	Te
	22	21	III	SI
11	23	18	I	TI
12	1	22	I	SI
	22	37	II	OD
	23	48	I	ER
13	21	05	I	Se
14	21	53	III	TI
	21	54	II	Se
19	22	19	I	OD
21	20	11	I	ER
	21	51	II	SI
	22	07	II	Te
25	23	20	III	ER
27	21	29	I	TI
	22	42	I	SI
	23	41	I	Te
28	22	01	II	TI
	22	06	I	ER
30	22	06	II	ER

(Times EST) E—Eclipse (satellite passes into shadow of planet). O—occultation (satellite passes behind planet). T—transit (satellite or satellite shadow passes across disk of planet). S—shadow. D—disappearance. R—reappearance. I—ingress (entrance onto disk). e—egress (exit from disk).

(Data from 1960 Observer's Handbook, Royal Astronomical Society of Canada.)

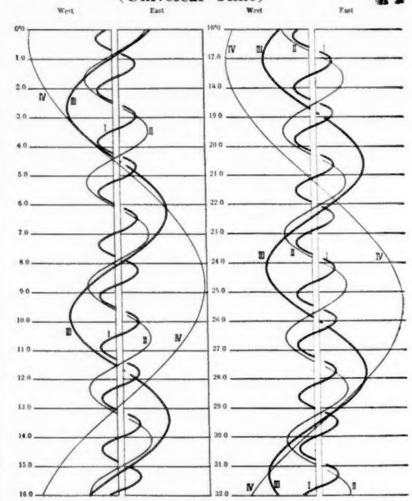
SATELLITES OF JUPITER—JULY 1960

(Universal Time)



SATELLITES OF JUPITER—AUG. 1960

(Universal Time)



EXPLANATION OF SATELLITE DIAGRAM

Effective with the unification of the British and American Nautical Almanacs this year, the configurations of Jupiter's bright satellites are now presented in a new and more useful type of diagram.

The central vertical band in the diagram represents the equatorial diameter of the disk of Jupiter. The relative positions of the satellites at any time with respect to the disk of Jupiter are given by the curves. In cases where a satellite is immersed in the shadow of Jupiter or occulted by its disk, the curve is interrupted.

The horizontal lines show the positions of the satellites at Oh Universal Time (Greenwich Mean Time) for each day of the month. For example, the horizontal line for the 15th of this month would show the positions of the satellites at 7:00 p.m. on the 14th of the month for an observer in the Eastern time zone.

(Diagrams taken from 1960 *American Ephemeris and Nautical Almanac.*)

SUMMER SHOWERS

By Edwin E. Friton

METEOR FRAGMENTS

Two of the best meteor showers of the year occur during July and August—the Delta Aquarids, which come to maximum on or about the night and morning of July 28th and 29th, respectively, and the Perseids, which will have their greatest rate on or about August 11-12. The Delta Aquarids will suffer very little from the moon, but, unfortunately, Perseid observations will be hampered considerably by moonlight both before and during maximum, as the full moon occurs on August 6th and the last quarter on the 14th. The saving grace for the latter shower is that the normal rate is high, about 50 meteors per hour or better. This means, of course, that a considerable number should be seen despite the moonlight.

The Delta Aquarids are a shower known from antiquity — the first known observations date from 784 A.D. The radiant is at R.A. 22h 36m, Declination 17° S., which means that these meteors will appear to radiate from a small area in Aquarius about 3° west of the star Delta. This region rises at about 10:00 p.m. local standard time at latitude 40° north, and will be at its highest (in the southern part of the sky) at about 2:30 a.m., so it will be above the horizon throughout the night.

The meteors from this shower are characterized by having low apparent speed and long paths. The rate at maximum (for all meteors) should be about 20 per hour, and the shower is visible for about 10 days before and after the 29th. As yet, no association with a comet has been established.

The Perseids, also known popularly as "The Tears of St. Lawrence," have a known history of well over 1,200 years. This is the best known and probably the most reliable annual meteor shower. This reliability is largely the result of three factors, (1) the meteorites of which the stream is composed are rather uniformly spread around the orbit, (2) the stream is quite extended in thickness, and (3) the inclination of the orbit to that of the earth's is very high (114 degrees) which keeps the stream away from the gravitational pulls of the major planets. The rate is usually more than 50 an hour, but there are rare occurrences, such as in 1921 when 250 per hour were recorded. On other very infrequent occasions, such as in 1911 and 1912, rates were extremely low, according to observations of the famous English observer Denning, as reported by Lovell in *Meteor Astronomy.*

An intruder flashes across the summer Milky Way in Cygnus, stealing the show from the delicate traceries of the Network nebula. This meteor path shows several peaks of brightness, as indicated by its varying width.

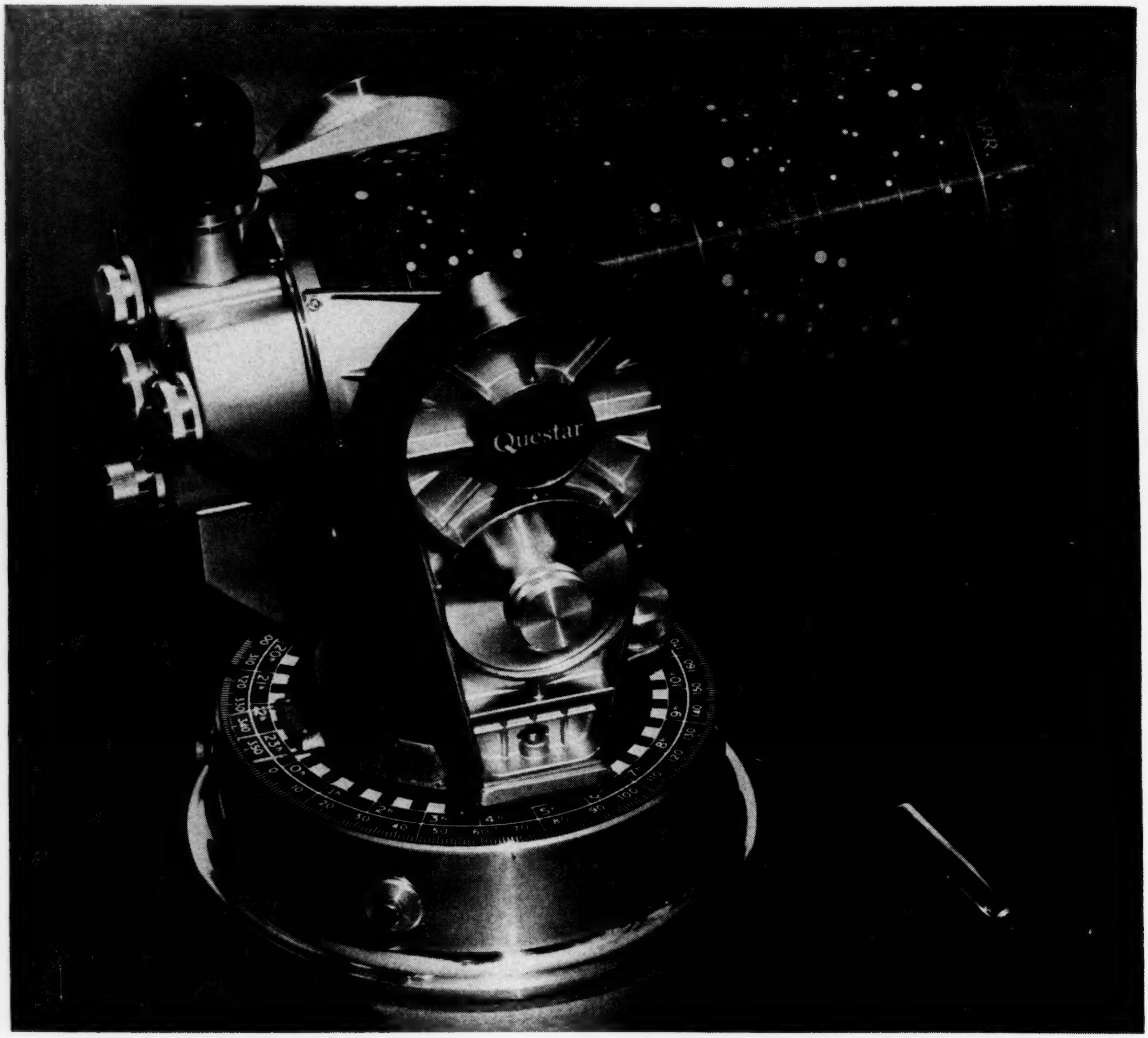
Yerkes Observatory Photograph

The radiant, which is at R.A. 3h 4m, Dec. 58° N., is above the horizon all night, and will be found in the northeastern sky until the wee hours. It comes to upper culmination (nearly overhead above the North Star), at about 5:30 a.m. in middle northern latitudes. The radiant is about 5° north (i.e. toward the North Star) of the star Gamma Persei. The meteors are quite swift, yellowish, and often leave beautiful trains in the sky, some of which endure for a number of seconds, and occasionally for several minutes. The duration, according to P. Millman, is about five days, although some Perseids may be seen as early as the middle of July and some as late as the middle of August.

This is the first meteor radiant shown to be moving during the course of a shower. There is still another first for the Perseids—they were the original shower that was shown to be connected with a comet, namely Tuttle's of 1861.

As usual, the American Meteor Society will appreciate any properly made meteor counts on these showers, or, for that matter, on any night whatsoever. The most essential ingredients of a scientifically useful observation are: (1) The count must be for one hour or more, (2) It must be one person's *individual record,* not a group total. Each observer should record only the meteors he sees, whether any of them are observed by another or not. (3) The sky, nearby lights, and obstruction conditions affecting the area of sky observed must be at least half as good as a perfect country sky (this definitely means that counts made within or too near large cities are of no value).

The information which should accompany every hour's observing are: (1) Name and address, (2) Observing location, (3) Sky and locality conditions (1.0 is perfect, 0.9 is nearly so, 0.5 is half perfect, 0 is completely clouded), (4) Compass direction, and the altitude in degrees of the center of the observed area. (The horizon is 0, half way to the overhead point is 45 degrees, and overhead is 90 degrees in altitude). (5) Beginning and ending times of periods, and kind of time used, (6) Number of meteors seen during each hourly period, (7) The date, given in the double-date system, as for instance the night of July 29th, morning of the 30th would be given as July 29-30, 1960. Observations should be sent to The Monthly Evening Sky Map, and they will be passed on to the appropriate regional director where there is one active, otherwise to Dr. Olivier, president of AMS.



LAY THAT BURDEN DOWN

When you finally get tired of lifting and carrying your telescope in and out of doors, tired of setting it up and taking it down in chilly darkness—

When you've had enough of heavy loads, of quivering tubes and images, enough of drives that falter and slow motions that fall short—

When you finally realize that it has become too much trouble to use your telescope any more because it only gives you an aching back and a pain in the neck—when you've had your fill of the contraption—*send for the Questar booklet!*

The Questar booklet will tell you how to lay your burden down. No more lifting, no more toting, no more setting up of heavy, clumsy parts. Questar weighs but 7 pounds, and is always assembled, always ready to use.

It will tell you about how Questar stands alone, the only thing of its kind, with the latest discovery in optics, the mixed lens-mirror system of the new catadioptric optics. How Questar's folded focal length keeps it fabulously short, how so short a telescope can be as stiff and rigid as a great observatory instrument. It will tell you how Questar's images are as rock steady as a microscope, how its controls are ready to your fingertips, and how its 360° continuous slow motions have a buttery smoothness with absolutely no backlash at all. It will tell you of finer performance than was ever dreamed of from only 89 mm. of aperture, and prove that point by the amazing resolution of the photographs it takes.

But hold on—let the booklet tell you this—let us use this space to tell you other things.

Let us speak, for instance, of investment value. Questar costs no more than ordinary 'scopes would if they were so well mounted as to be equally solid and vibration free. But let's face it—Questar optics cost more by the extra hours of human labor required to make, for example, mirrors that must be 16 times more accurate of figure than the ordinary kind. Questar's mounting, too, has over 235 separate parts, each one of the best procurable alloys down to the last tiny screw.

So let us tell you what we have found out—that Questars are so greatly in demand that the few which reach the second-hand market depreciate an average of less than 7% per year! Imagine this—Questars over three years old bring 80% of their purchase price! We know of nothing manufactured with such amazingly high value at resale.

Remember then, that if you too become a Questar owner, you will be making the most conservative investment possible. We firmly believe that it will cost you less per year to enjoy a Questar.

Questar, as illustrated, still costs only $995 postpaid, in hand-made, velvet-lined English leather case. Terms are available. May we send you the booklet?

Questar
BOX 40 NEW HOPE · PENNSYLVANIA

BOOK REVIEWS

PHOTOGRAPHIC LUNAR ATLAS

(University of Chicago Press, 1960; edited by Gerard P. Kuiper; 230 sheets, 281 photographs; $30.00.)

By Robert E. Cox

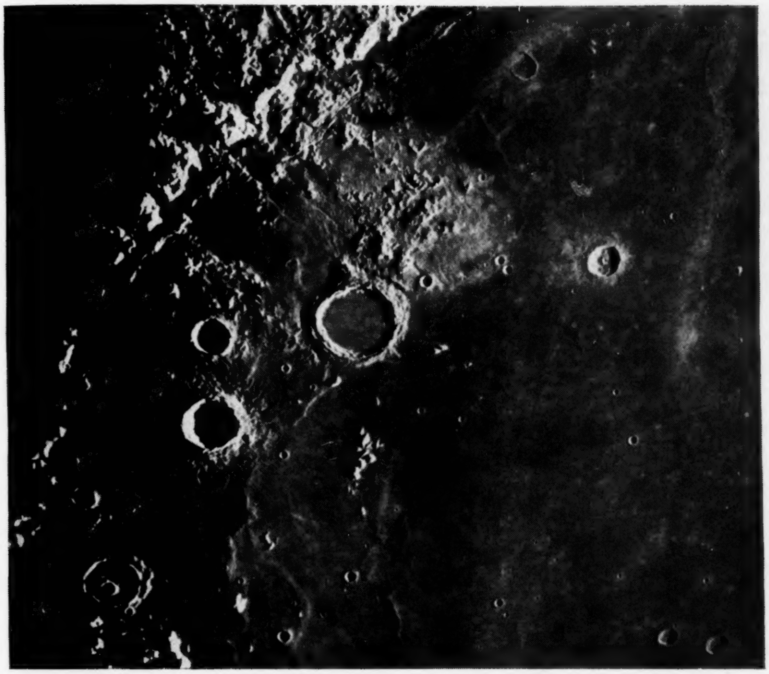
Selenography, the study of the physical features of the Earth's nearest neighbor, the Moon, is a field of astronomy in which the amateur astronomer can make valuable contributions. Designed specifically to aid the astronomer in his lunar studies, the *Photographic Lunar Atlas* is a collection of the best photographs taken at the Mount Wilson, Lick, Pic du Midi, McDonald and Yerkes Observatories. It was edited by Gerard P. Kuiper with the collaboration of D. W. G. Arthur, E. Moore, J. W. Tapscott and E. A. Whitaker, and represents over four years of intensive study and work. A 23-page pamphlet of explanation and lists of lunar features is included.

It is almost impossible to describe the beauty of the prints of this atlas, but just knowing that they are made from the best negatives available throughout the world today should help the user realize the splendor of their presentation. The scale adopted is for a full moon of 100 inches (1 inch equals 21.6 miles or 1 mile equals 1.2 millimeters), and the best resolution obtained in the 16x20-inch pictures is around 0".4, corresponding to about ½ mile. This is about the limit of resolution of an 11-inch telescope under excellent seeing conditions.

The main body of the atlas has the whole moon's surface represented in 44 charts, but each view includes the area under different lightings, or four charts per set for a total of 176 individual pictures. Each of the principal charts is a large sheet folded in four parts and labeled *a*, *b*, *c*, and *d*. In *a* and *b*, one morning and one evening view under a moderately high sun is presented, showing details reasonably well, but avoiding the sunset or sunrise line across the field. The same field viewed under full moon or a high sun is given in *c*, while *d* is a field supplementary to *a* and *b* and often shows one or two views with low-oblique lighting.

The fields of the main body of the

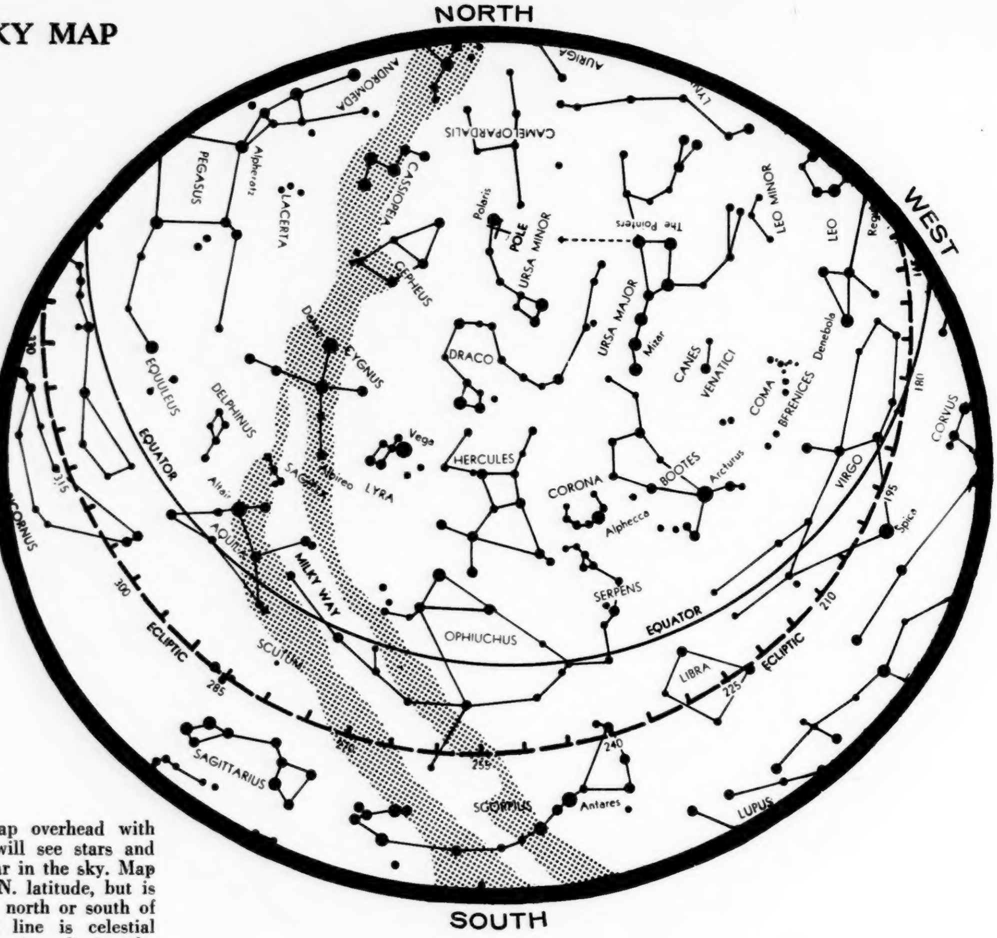
(*Continued on Page* 16)



Using enlarged sections of such fine lunar photographs as this one of the region surrounding the large crater Archimedes, the "Photographic Lunar Atlas" brings the lunar surface to our scrutiny under four angles of illumination. Intended for professional use, this epic work has value to individual amateurs or to organizations for group projects.

Lick Observatory Photograph

EVENING SKY MAP FOR JULY



Face south, hold map overhead with north at top. You will see stars and planets as they appear in the sky. Map is designed for 40° N. latitude, but is practical ten degrees north or south of that latitude. Solid line is celestial equator; dashed line is ecliptic, the apparent path of sun and planets.

10:00 P. M., July 1 9:00 P. M., July 15 8:00 P. M., July 31

(*Continued from Page* 15)

set are designated by grid letters and numbers, A to F and 1 to 8, as well as by the name of some well-known or prominent feature included within the area shown. There are 35 supplementary sheets covering limb areas with favorable librations and selected lunar portions containing unusual amounts of detail of interest to the observer.

The paper and printing process has been chosen so an observer can make alterations with crayons, pencil, or ink when working at the telescope. It is advisable for those contemplating such changes to secure two sets of prints so one picture of original details will be available for later reference. One noticeable fault of the printing is the ease with which the dark areas pick up smudges from the oils in the skin of the fingers, but this can be prevented by wearing light cotton gloves when handling or by covering the prints with thin sheets of clear plastic.

For the serious amateur considering studying and drawing the lunar surface this set of charts is a must, but as a club item it should also have tremendous appeal. The pictures can be used to illustrate lectures and for displays at meetings (it is recommended that if handled a great deal they be cut apart and mounted on stiff cardboards). Also, individual charts loaned to members to study with their own telescopes and report on the limits of detail they were able to reach should prove an exciting project. Moderate-size telescopes, 4 to 8 inches, will of course be unable to reach the limits of the pictures; however, those possessing 10- and 12-inch instruments can see if these instruments can equal or exceed the limits of detail shown.

Although the cost, $30, seems high for amateurs (actually this atlas was prepared for the professional under the encouragement of the International Astronomical Union), when one considers that here are 16x20-inch murals or displays at a cost of about 10 cents a sheet the magnitude of the bargain becomes apparent.

LAROUSSE ENCYCLOPEDIA OF ASTRONOMY

L. Rudaux and G. de Vaucouleurs. 508 pp. New York: Prometheus Press, 1959. $15.00.

By Armand N. Spitz

Every now and then—and unfortunately, it is too seldom—there comes a book in astronomy which, almost from the date of publication, is clearly destined to become a classic. It does not take long to recognize the existence in one volume of all that makes for a successful book of reference which will be of value, not only to the professional astronomer, but also to amateur astronomers at all points along the capability spectrum, and to people who may not even think of themselves as amateur astronomers but who are only interested in being aware of the universe in which they live.

Such a volume is the *Larousse Encyclopedia of Astronomy*, published by the Prometheus Press of New York. The product of the late Lucien Rudaux and Gerard de Vaucouleurs, this tremendous volume was originally published in France as a part of the famous Larousse series of encyclopedias.

The astronomically minded student seldom buys his text books or reference works in airports, railroad stations or bus terminals. From personal observation, I would venture a guess that there is not one of these outlets, any more than there is any legitimate book store, which does not have the *Larousse Encyclopedia of Astronomy* prominently on display—with a sizable stack of volumes in reserve. Somehow or other, the general public as well as the starry-eyed student must be interested in this volume.

What other volume so thoroughly and interestingly covers the story of astronomy from its very beginnings up to artifical satellites and radio astronomy? It is unfortunate that, within a matter of months after the publication of the volume, such new astronomical concepts as radiation belts and structural understanding of the sun through high-altitude ultraviolet photographs—by the fact of their omission—caused the volume to

(*Continued on Page* 18)

(*Continued from Page* 17)

be very accurately dated. But after all, books have to come out, and rare indeed is the volume which is not so dated by the very cutoff of the matter which it includes.

Here, then, is the astronomy book for everyone. The text is comprehensive, yet the presentation is as lucid as anyone could desire. The two authors represent too high a plane of astronomical achievement to find lack of acceptance on the part of other astronomers. Rudaux's illustrations, both diagrammatic and pictorial, plus excellently reproduced photographs, both in black and white and in color, combine to make the volume one which will be kept, not only near at hand, but in a place of prominent display. What more can one ask of a textbook in astronomy?

THE BEGINNER'S GUIDE TO THE STARS

R. NEWTON and MARGARET W. MAYALL. 184 pp. New York: Putnam's, 1960. $2.50.

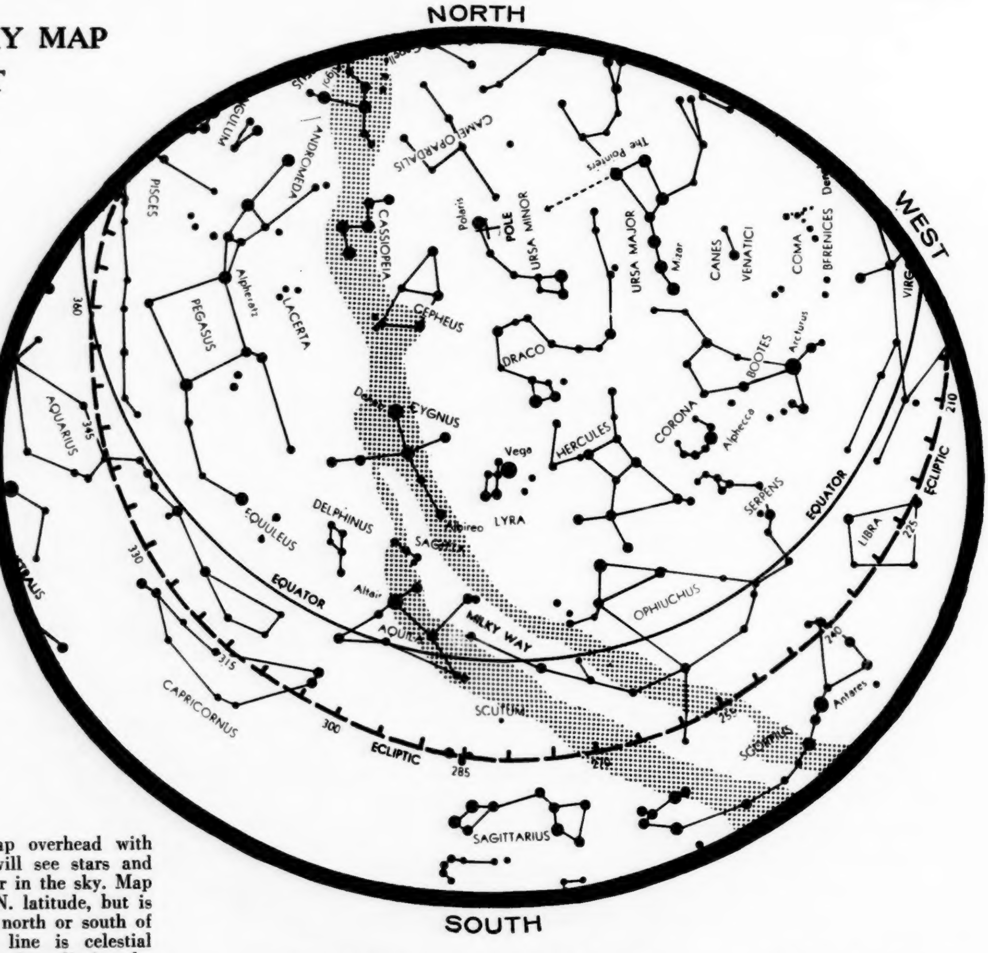
THAT ELLERY QUEEN team of the astronomical w o r l d is at it again! Margaret and Newton Mayall, with their names already signed to four books on the current market, have now added a fifth. This small volume, clean and well organized, is designed to fit the needs of the reader who is completely new to the field of astronomy.

After a brief introduction, definition of terms and general orientation, the reader is taken on a digested tour of the universe and the phenomena which occur within it. The use of binoculars to further penetrate the mysteries of space is then covered, after which attention is focused on the solar system.

The main feature of the book is its charts and accompanying text. These charts are simple but useful, and each one includes but one or two constellations at a time. A valuable accompaniment to each chart on the facing page indicates the months and place in the sky of that star-group's visibility, the "character" of the constellation as indicated by its basic shape or other characteristic, and brief notes touching on objects of naked-eye or binocular interest.

The Beginner's Guide to the Stars is actually a preparatory volume to the author's recently revised *Field Book of the Skies*, a volume which covers the same area with greater depth for more serious observers with small telescopes. —DDZ

EVENING SKY MAP FOR AUGUST



Face south, hold map overhead with north at top. You will see stars and planets as they appear in the sky. Map is designed for 40° N. latitude, but is practical ten degrees north or south of that latitude. Solid line is celestial equator; dashed line is ecliptic, the apparent path of sun and planets.

10:00 P. M., Aug. 1 9:00 P. M., Aug. 15 8:00 P. M., Aug. 31

STANDARD HANDBOOK OF TELESCOPE MAKING

N. E. HOWARD. 326 pp. New York: Crowell. $5.95.

By TOM R. CAVE, JR.

THIS is the latest book on the market on the amateur telescope making subject. The author has for some years been a teacher of physical sciences at the Millbrook School for boys in New York State, and he gives a very clear step-by-step introduction to the entire field of telescope making.

He has broken away from the age-old custom of prescribing a 6-inch, f/8 mirror for the beginner, and suggests that an 8-inch, f/7 is about as easy as the more conventional size.

Particularly excellent are the chapters on fine grinding, making the pitch laps, and the polishing of the beginner's first mirror. Perhaps the most outstanding chapters in this excellent new book are those covering testing and figuring—including some extremely good drawings and photographs made by the author and his associates at the Millbrook School.

The title of this book is perhaps a somewhat misleading one, since the book is actually a very simple but clear introduction to the construction of the amateur's *first* telescope. Unlike the three *Scientific American* telescope-making books, no section of this new work is at all complicated or technical. It is perhaps the most simple and straightforward book on telescope making available to the absolute beginner. It not only covers the construction of an 8-inch, f/7 Newtonian reflector and mount, but also discusses in some detail accessories such as clock drives, finders, setting circles, and the amateur's home-made observatory (an area poorly covered in the literature).

A special feature includes an excellent chapter on celestial photography, well illustrated with photos by G. T. Keene, a well-known amateur of Rochester, N. Y. The glossary and several sections of the appendix (a rich nugget of data and practical information) will be of particular use to many beginners. This new work is highly recommended to the beginning telescope maker, yet is also a useful addition to the library of the more advanced worker.

THROUGH THE THREE-INCH

Leonard Megginson, Clayton, Mo., amateur, cradles his home-made 4¼-inch "richest field" 'scope in his arms and prepares for an evening of "armchair astronomy."

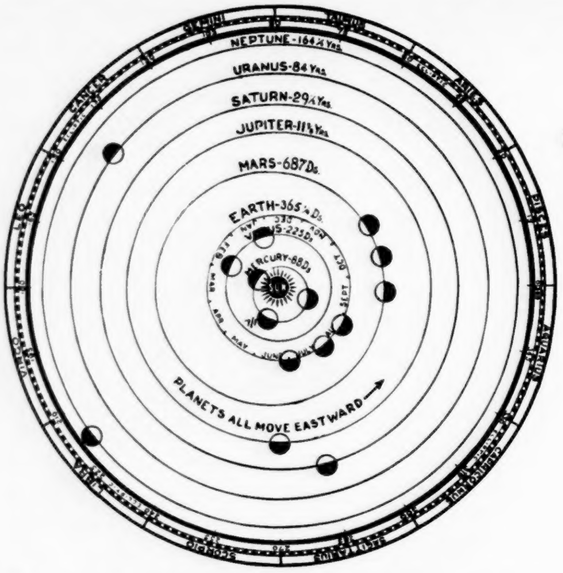
We know of many beginning amateurs— and a few whose beginnings go back a number of years—who are suffering from "powerosis." Their best friends haven't told them, however—quite possibly because they're too busy trying to glimpse the object they're supposed to be seeing at 350x. Now, power has its place—planetary and lunar detail, splitting close double stars, and a few other amateur applications—but for a moment we're going to talk about low powers, and the "high-powered" observing you can enjoy with them.

There is nothing more exciting in astronomical observation than a low-power view of a bright star-field or coarse cluster—in fact, such views cannot be obtained in any other way. In most cases, low powers mean wide fields of view—fields of view that let you really look at the stars. Low powers also minimize some of the minor imperfections in a first home-made mirror or the distortions caused by improper alignment—negative points, but practical ones.

Of course, there is a limit to the lowest power any specific telescope can use. The size of the final ray of light which leaves the eyepiece and enters the eye can't be any larger than the pupil of the eye it is entering. You can't squeeze a half-inch "pencil" of light into a pupil that is only one-third of an inch in diameter (the average size of a pupil adapted to darkness). You're also limited by the focal length of your telescope. If the image formed by your mirror or objective lens comes to a focus at 50 inches, a one-inch eyepiece (about 25mm) gives you 50 power. An eyepiece of 1½-inch focal length would give this telescope about 38 power, but that would be as low as you could go satisfactorily. Such magnifications—40-50—are sufficient for at least half of the objects you will be observing.

However, there is a way of obtaining even lower powers and wider fields. Nearly 50 years ago an English amateur realized that there was a happy combination of mirror or lens aperture, telescope focal length, and magnification which would give the user the "richest field" possible in *any* telescope—more stars in the field of view than any other telescope, from the biggest telescope on down to the smallest. The density of stars—in the Milky Way, let's say—increases at a steady rate until about the 11th or 12th magnitude. After that, this increase drops off, and the "star-gathering" efficiency of the bigger instrucents begins to decrease, even though fainter stars are seen.

A 6-inch mirror, figured to a focus of 24 inches, and using a magnification of about 21 power, satisfies these demands. The writer has used one for years, and for Milky Way star fields there is nothing—literally —which approaches it for spectcular views. Playing loosely with this combination, one can achieve even lower powers and wider fields with the loss of a few stars and build or assemble a 4¼-inch "richest field" telescope like that made by Leonard Megginson and illustrated above. It works at about 15 power—you cradle the little gem in your arms and your eye just follows its inclinations as you run through the star-strewn path of the Milky Way. We'll talk more about this and similar instruments in the next issue. —DDZ



HELIOCENTRIC POSITIONS of the PLANETS for JULY and AUGUST 1960

This chart shows the solar system as it would appear if viewed from a point directly above the sun (in relation to the plane of the ecliptic). Heliocentric positions of the planets are measured in degrees of longitude, eastward from the First Point of Aries. Owing to space limitations, the orbits of outer planets are not to scale. Positions at beginning, middle and end of two-month period are shown for Mercury, Venus, Earth and Mars—mean position during period is shown for each of the outer planets.

AL CONVENTION SEPT. 3-5

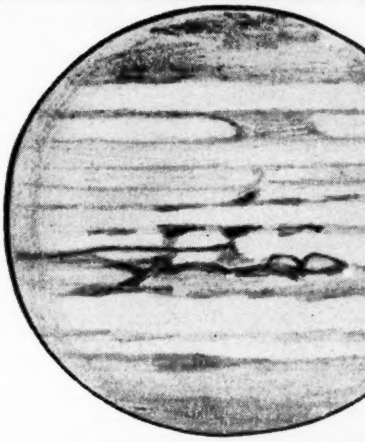
The 1960 Astronomical League Convention has been scheduled for Sept. 3-5 on the campus of Haverford College in suburban Philadelphia. Any interested amateur may attend. Sessions will cover all fields of amateur interest, and special trips to nearby observatories and other points of astronomical interest have been planned.

Sessions will begin on Saturday, Sept. 3rd, and will end with a banquet and guest speaker on Monday, which is Labor Day. Observing sessions will be held in the evenings.

General convention chairman Edwin F. Bailey suggests that advance registration and dormitory reservations be made before Aug. 15th to assure accomodations. Information concerning reservations, registration and program schedules may be obtained from Mr. Bailey at the Franklin Institute, Philadelphia 3, Pa.

YOUR TELESCOPE AND MINE

THOMAS R. CAVE, JR.



Jupiter (T. R. Cave)
8" reflector—230 power
April 2, 1959
8h 45m-9h 00m UT

Remarks: Seeing variable due to high, thin clouds. Nearly all System I very rust or brick red—very intense — many small white spots suspected on exact equator.

This drawing by the author indicates some of the planetary detail which can be grasped by an experienced observer using good optics. Main activity at time of drawing centers in northern component of Jupiter's equatorial belt (System I). Equatorial area has rotation period more than 5 minutes faster than rest of planet, requiring two systems for timing central meridian transits of planet's markings. South is at top.

THE last half of 1960 promises to be an outstanding period for planetary observing. Now, with the arrival of warm weather and balmy nights, observing conditions improve, and the two most spectacular planets, Jupiter and Saturn, are now once again in the evening sky. They will be well placed for serious observation until late summer and early autumn, and, by the time these giants begin to set in the early evening, his mysterious majesty Mars will become available for observation.

One of the very first objects nearly every beginning telescopist observes with his new telescope is Jupiter. Jupiter's large apparent diameter (45″ to 50″ of arc) makes it a comparatively easy object in any telescope. Even small refractors and reflectors, i.e., 2½-inch to 4-inch apertures, reveal some hint of the wealth of detail to be seen in its ever-changing cloud belts. An excellent 6-inch telescope will begin to resolve many of the irregularities in the belts into distinguishable details. A 6-inch telescope is also fully capable of exhibiting as disks of different size the four major Jovian satellites, since all four moons have an apparent diameter which is within the resolution limit of a 6-inch instrument. Ganymede actually has a diameter of about 1.5″ of arc at mean opposition, and it is easy for an experienced observer with a 6-inch or larger telescope to distinguish each satellite by its apparent diameter in the telescope.

As much fun as it may be to make casual observations of Jupiter in a 6-inch or larger telescope and watch the fleeting markings on the belts, it is far more enjoyable to observe the planet seriously and with purpose. Truly, much of our present knowledge of Jupiter, including its varying rotation period in differing latitudes, and the drift of enduring markings such as the Great Red Spot and several large white spots, has been due almost entirely to the efforts of serious amateur observers over the last 80 years. With a few exceptions, all of this observational work has been done with 6- to 12-inch telescopes.

The serious and well-organized members of the Jupiter Section of the British Astronomical Association have, ever since 1890, been carefully drawing the fine belt details of Jupiter and making and reducing tens of thousands of central meridian transits of dark condensations and white spots on the belts of Jupiter. Since World War II similar work has been done by the serious observers in the Association of Lunar and Planetary Observers in America. The result of this long-term program is an exceedingly accurate series of rotation periods in the various latitude zones of Jupiter.

Much valuable information has also been gradually accumulated about some long-lasting disturbances such as the Great Red Spot, the South Tropical Disturbance, and several enduring white spots. In England much of the pioneering work on Jupiter was done by W. F. Denning and A. Stanley Williams in the last decades of the 19th century, followed by the great work of the Rev. T. E. R. Phillips and more recently by B. M. Peek and F. J. Hargreaves. Few of these observers regularly used large apertures.

In America, regular observations of Jupiter were begun about 1910 by the late Latimer J. Wilson, and during the last 25 years much of the work has been done by ALPO Direc-

(*Continued From Page 21*)

tor Walter H. Haas and Elmer Reese. It is particularly noteworthy that all of Reese's widely recognized work has been done with a homemade 6-inch reflector—singular proof indeed that important planetary work can be done with a small telescope in the hands of a dedicated and highly experienced observer.

Much experience can be gained merely by observing Jupiter as frequently as conditions and time permit and, whenever possible, making a careful sketch of all the detail on the belts which can be seen. Two or three sketches a week are about the average that most serious observers make of Jupiter, and the beginner will soon be amazed at the increased amount of detail he can sketch after a few weeks' practice. He will soon find himself becoming familiar with certain detached segments of belt detail, which often persist for weeks and sometimes months on Jupiter. He will begin making central meridian transits of many of these markings and graphing their rotation periods and drift.

A 'scope larger than 6 inches, provided it is a good one, will increase the amount of fine Jovian detail visible. With a 12-inch telescope (or larger) detail can occasionally be glimpsed on Ganymede, the third satellite of Jupiter. Such observations can only seldom be made, and then by using powers well above 500x when seeing conditions are near perfect.

Saturn is always a beautiful and delicate object to observe, but the belt details on the disk of the planet exhibit a singular lack of change. With telescopes of 12 inches or larger, small dark condensations can occasionally be seen on the dusky main belts of Saturn. Very rarely large, bright white spots occur. In 1898-99 a white spot was observed for several weeks, and in August, 1933, an exceedingly large white spot was discovered by Will Hay, the British stage star and amateur astronomer, with his 12-inch telescope. This white spot lasted a number of weeks and was closely followed by several observatories.

On April 29, 1960, Dr. A. Dollfus, observing at the Pic-du-Midi Observatory in France, discovered a brilliant white spot in Saturn's northern hemisphere. This spot has been observed since on several occasions by the writer and is without doubt the greatest outbreak of activity on Saturn since 1933. At the time of this writing the spot was not accessible to small telescopes.

The finer divisions in the ring system of Saturn are extremely interesting and within the reach of 10-inch telescopes. Even a $2\frac{1}{2}$- or 3-inch refractor will easily reveal the conspicuous Cassini division, but a 6-inch telescope will often show the Encke division of the outer ring. Several divisions have been observed within the main bright ring of Saturn, as well as one separating this ring from the crape ring. For ten years a second very faint crape ring has been suspected just outside the main ring system, but this detail, if real, should only be verifiable when the rings are nearly edgewise to the earth.

This summer and autumn will afford many beautiful views of Jupiter and Saturn, and it is hoped that some possessors of good telescopes will undertake the absorbing and delightful work of serious planetary observing.

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